Electric Potential and Field Instrument for CubeSat (EPIC), Phase II Project

SBIR/STTR Programs | Space Technology Mission Directorate (STMD)

ABSTRACT

Our present understanding of magnetosphere-ionosphere coupling is limited, partly due to the lack of broad statistical observations of the 3-dimensional (3D) electric field in the altitude region between 300 and 1000km. This understanding is of national importance because it is a necessary step toward developing the ability to measure and forecast the "space weather" that affects modern technology. The high cost of space access and short satellite lifetimes below 500 km make traditional satellites uneconomical for performing these measurements. Therefore, it is desirable to develop smaller and lower-cost sensor/satellite systems, such as CubeSats, so that the largest possible number of distributed measurements can be economically made in this region. The proposed project seeks to develop a 3D vector electric field instrument that can be accommodated in less than half of a 6U (10x20x30 cm) CubeSat. This instrument is enabled by CTD's game changing deployable composite boom technology that provides lightweight, stiff, straight, and thermally stable booms capable of being stowed within a CubeSat form factor. The proposed development will also provide the CubeSat community with the capability to include one or more deployable booms with lengths greater than 5 meters for future CubeSat missions.

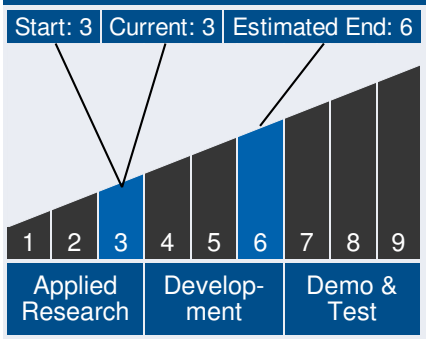
ANTICIPATED BENEFITS

To NASA funded missions:

Potential NASA Commercial Applications: The proposed CubeSat E-field instrument will enable multipoint e-field measurements to be made economically in the region between 300 and 1000km. This is relevant to the scientific goals outlined in the 2013-2022 decadal survey in solar and space physics, as stated: "Determine the dynamics and coupling of the earth?s magnetosphere, ionosphere and atmosphere and their response to solar and terrestrial inputs." It is also relevant to the NASA 2009 Heliophysics Roadmap, as outlined in the living with a star

Table of Contents

Technology Maturity



Management Team

Program Executives:

- Joseph Grant
- Laguduva Kubendran

Program Manager:

- Carlos Torrez

Continued on following page.

Electric Potential and Field Instrument for CubeSat (EPIC), Phase II Project

science queue: "Dynamic Geospace Coupling: Understand how magnetospheric dynamics provide energy into the coupled ionosphere-magnetosphere system." In addition, the proposed boom technology can be used for magnetometers, particle sensors, gravity gradient stabilization for small spacecraft, or for deploying solar sails, solar arrays and phased array antennas.

To the commercial space industry:

Potential Non-NASA Commercial Applications: The U.S. military has increasing interest in utilizing low-cost spacecraft platforms that can be rapidly launched for the purposes of Space Situational Awareness (SSA) and space weather monitoring. The proposed instrument would have applicability for missions similar to the Air Force's Communications/Navigation Outage Forecasting System (C/NOFS), which allows the U.S. military to predict the effects of ionospheric activity on signals from communication and navigation satellites, outages of which could potentially cause problems in battlefield situations. In addition, both military and commercial satellites could use gravity gradient booms, instrument booms, optical and antenna reflectors, sunshades, deorbiting systems, solar arrays, phased arrays, and solar sails based on this deployment technology.

Management Team *(cont.)*

Principal Investigator:

- Dana Turse

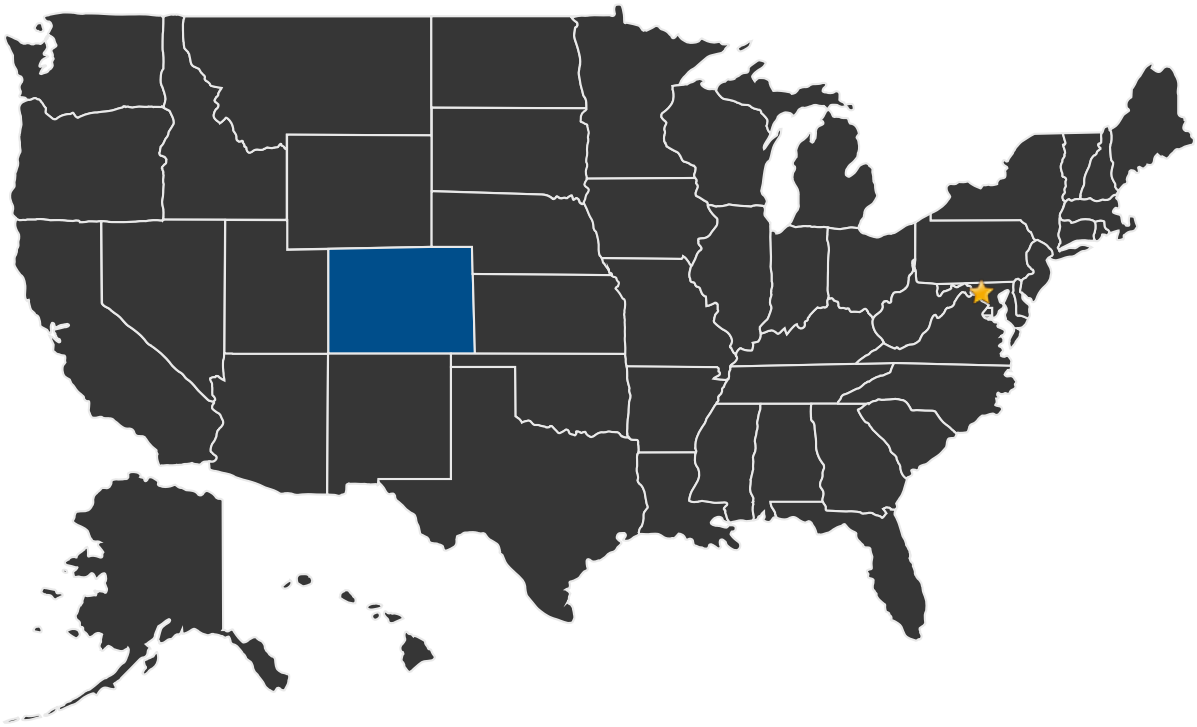
Technology Areas

Primary Technology Area:
Science Instruments, Observatories, and Sensor Systems (TA 8)
└ Remote Sensing Instruments and Sensors (TA 8.1)
  └ Electronics (TA 8.1.2)

Electric Potential and Field Instrument for CubeSat (EPIC), Phase II Project

SBIR/STTR Programs | Space Technology Mission Directorate (STMD)

U.S. WORK LOCATIONS AND KEY PARTNERS



U.S. States With Work

Lead Center:
Goddard Space Flight Center

Other Organizations Performing Work:

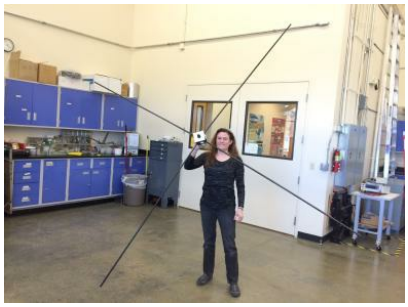
- Composite Technology Development, Inc. (Lafayette, CO)

PROJECT LIBRARY

Presentations

- Briefing Chart
  - (http://techport.nasa.gov:80/file/23570)

IMAGE GALLERY



Electric Potential and Field Instrument for CubeSat (EPIC), Phase II

DETAILS FOR TECHNOLOGY 1

Technology Title

Electric Potential and Field Instrument for CubeSat (EPIC), Phase II

Potential Applications

The proposed CubeSat E-field instrument will enable multipoint e-field measurements to be made economically in the region between 300 and 1000km. This is relevant to the scientific goals outlined in the 2013-2022 decadal survey in solar and space physics, as stated: "Determine the dynamics and coupling of the earth?s magnetosphere, ionosphere and atmosphere and their response to solar and terrestrial inputs." It is also relevant to the NASA 2009 Heliophysics Roadmap, as outlined in the living with a star science queue: "Dynamic Geospace Coupling: Understand how magnetospheric dynamics provide energy into the coupled ionosphere-magnetosphere system." In addition, the proposed boom technology can be used for magnetometers, particle sensors, gravity gradient stabilization for small spacecraft, or for deploying solar sails, solar arrays and phased array antennas.